Integrated Design Capability / Instrument Design Laboratory

Ocean Color Experiment Ver. 2 (OCE2)

~ Concept Presentations~

Electrical

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Electrical Subsystem Presentation

Document electrical architecture

- Functional requirements
- Electrical block diagram
- Indicate redundancy (baseline configuration)
- Estimate instrument power needs for average, peak, and survival cases
- Document electrical interface assumptions and estimate harness mass
- Estimate telemetry rates and the required S/C data storage

Electrical Subsystem Functions

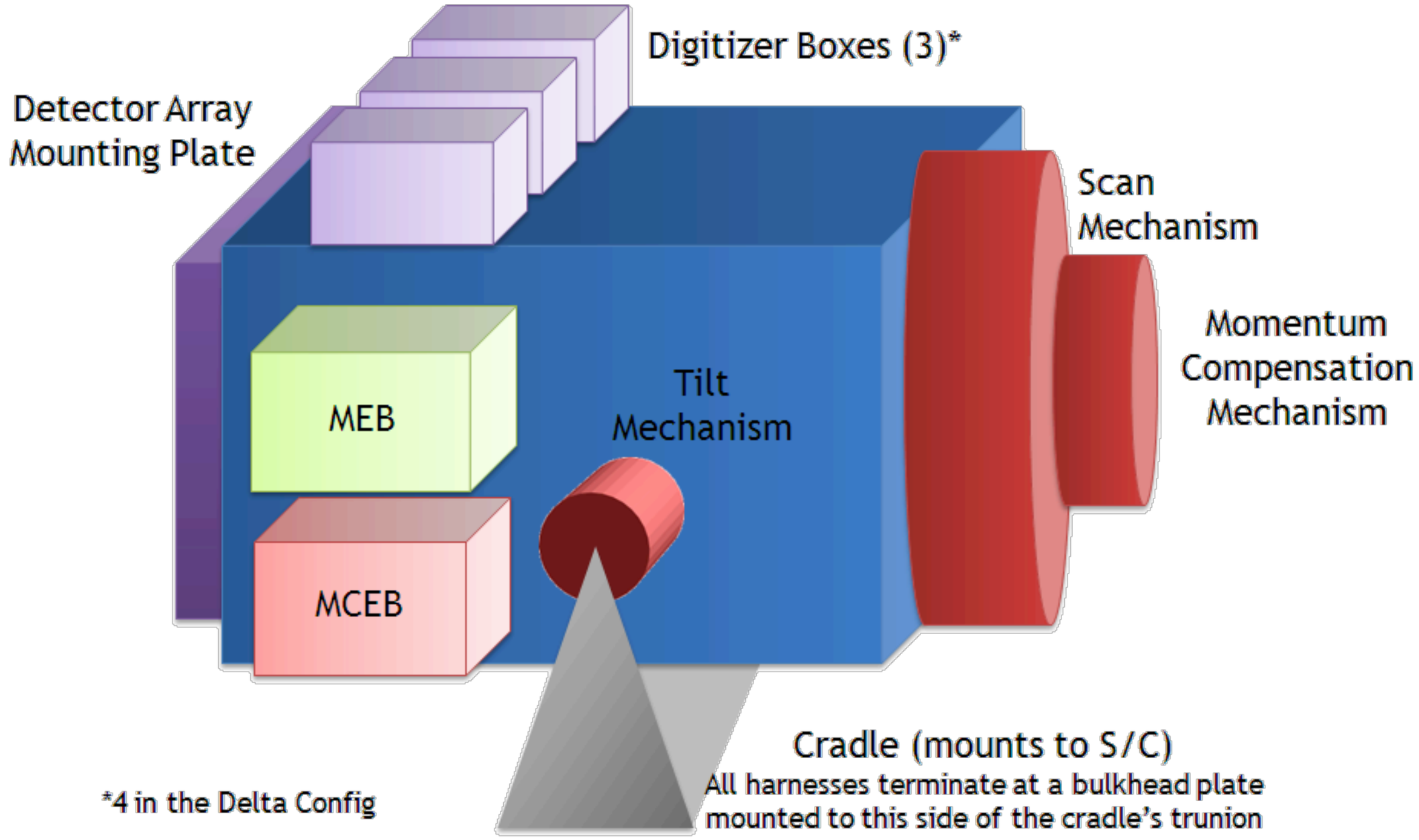
Realize an electrical architecture and instrument processing capability consistent with the mission class and lifetime

- Class C Mission
- 3 year minimum operation, 5 year goal

Control all hardware

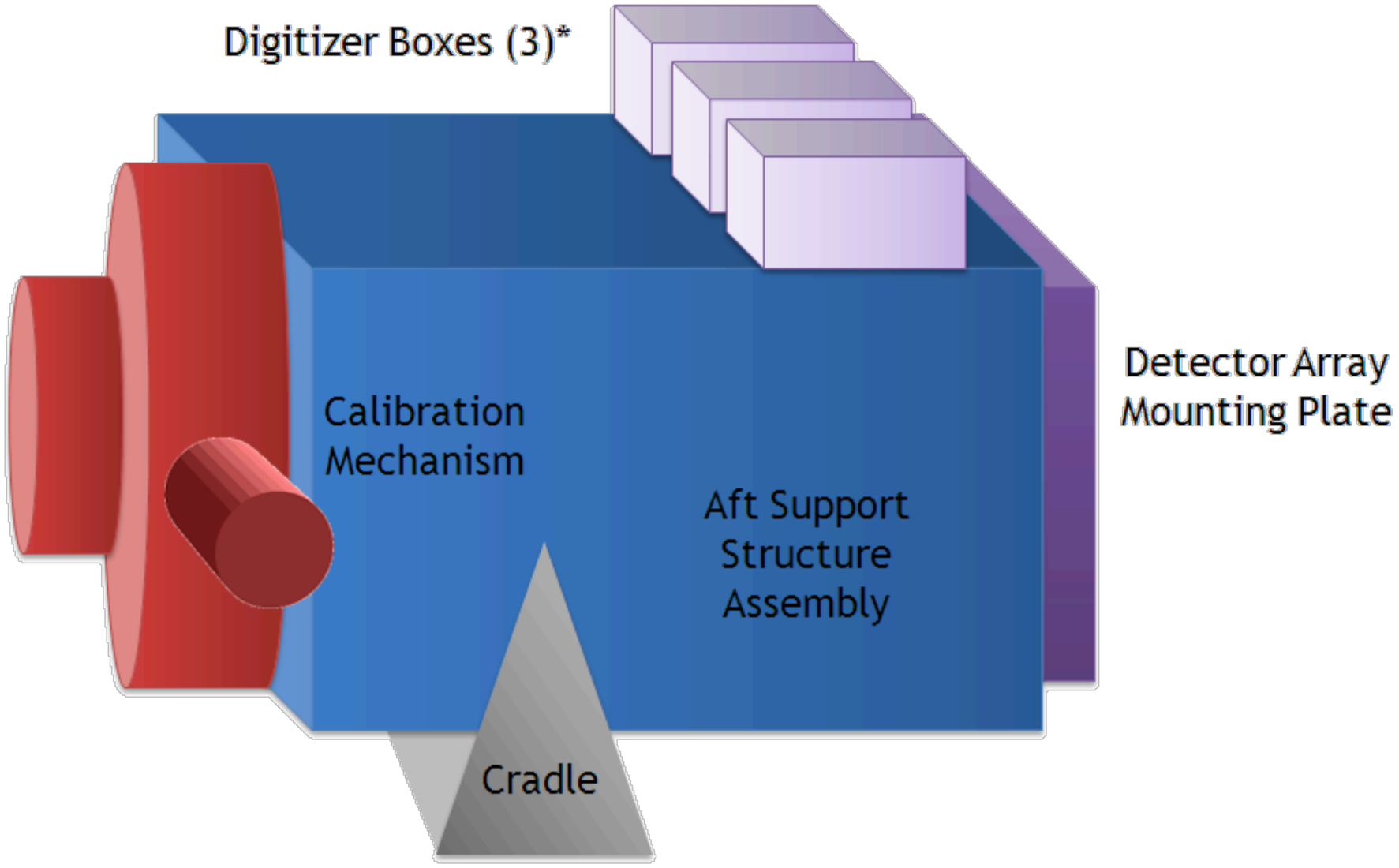
- Realize electrical hardware and processing capability to control all instrument functions: instrument modes, housekeeping monitoring, power conditioning, telemetry packetization
  - Switching between redundancy is commanded from the ground
- Readout detectors: process raw data, control CDS readout, compress raw data
- Perform integration control algorithm
- Control all mechanisms (5): scan, half angle mirror, momentum compensation, tilt, and calibration
  - Launch lock mechanisms are controlled by S/C
- Control all thermal hardware

Electrical Box Arrangement



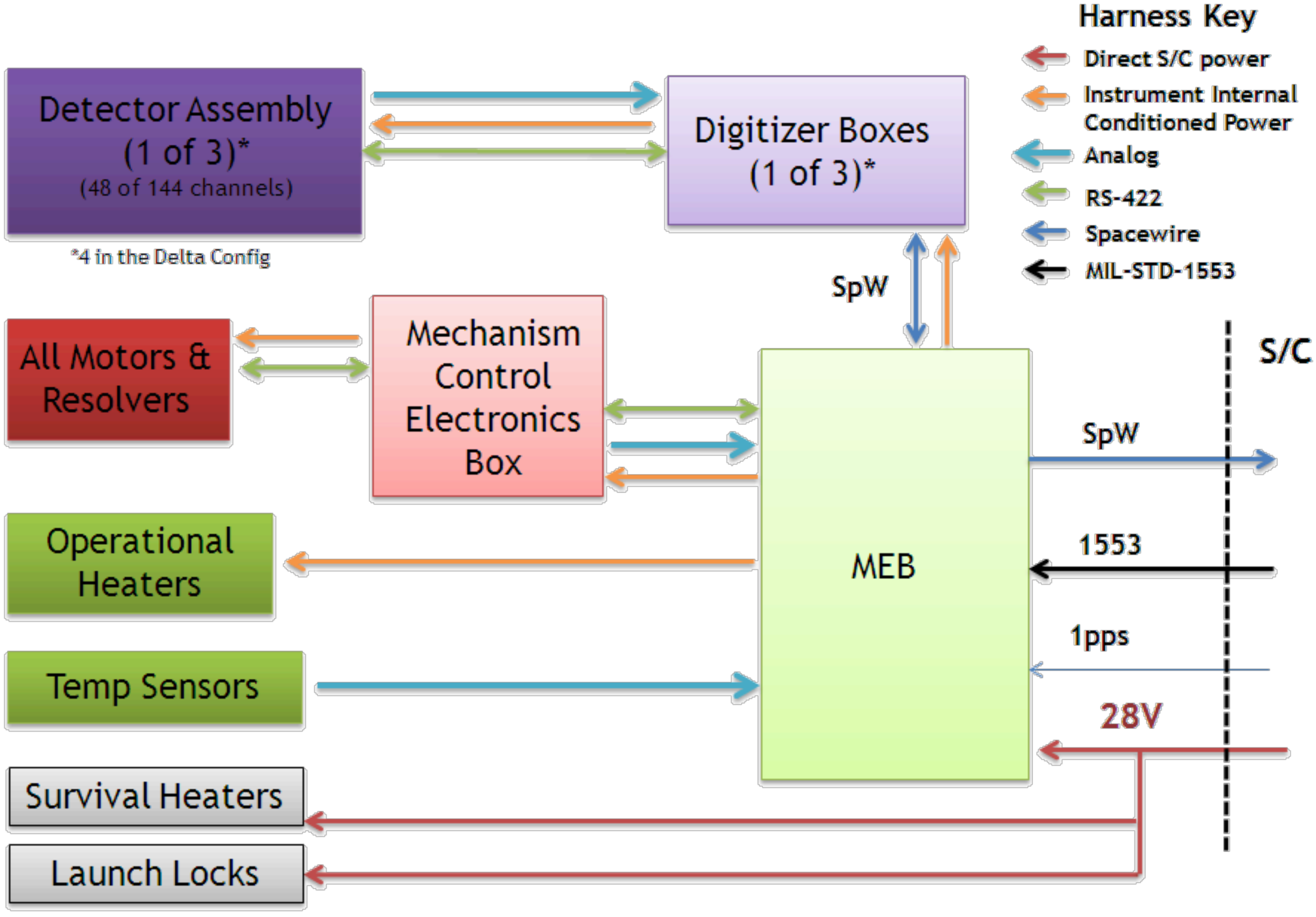
*4 in the Delta Config

Electrical Box Arrangement



*4 in the Delta Config

Electrical Interfaces



Electrical Board/Box Summary (Baseline)

Box*	Boards	Board Mass*	Chassis Mass Dimensions	Total Mass
Main Electronics Box (MEB)	5 6U Cards: • CPU • Housekeeping • Thermal Control (2) • LVPS	0.59kg/each 3.4kg Total	1.5kg 10x7.3x6” 25.4x18.5x15.2cm	5.0kg
Detector Digitizer Boxes (3)	7 6U Cards: • Digitizer boards (5) • Compression and Spacewire Merge • LVPS	0.59kg/each 5.5kg Total	2kg 10x7.3x9” 25.4x18.5x22.9cm	7.5kg/each 22.5kg Total
Mechanism Control Electronics Box (MCEB)	9 6U Cards: • Scan Control (A/B) • HAM Control (A/B) • Mom Control (A/B) • Tilt Control • Cal Control • LVPS	0.59kg/each 6.2kg Total	2.1kg 10x7.3x10” 25.4x18.5x25.4cm	8.3kg

* Each box also includes a backplane

Power Summary (Baseline)

OCE2 Baseline Configuration	Peak	Average
Scan Drum Assembly	**70**	**14.8**
Motor/Inductosyn	50	12
Half Angle Motor/Inductosyn	20	2.8
Launch Locks for Scan (powered by S/C)	4.5	0
Momentum Compensation Assembly	**50**	**47**
Cradle Assembly	**30**	**0**
Tilt Mechanism Motor 1/Resolver	15	15
Tilt Mechanism Motor 2/Resolver	15	15
Launch Locks for Tilt (powered by S/C)	4.5	0
Aft Optics Assembly	**401**	**385**
Preamp, FET switches, FET driver (1W each)	144	144
Digitizer Electronics Box (30W each)	90	90
Main Electronics Box	136.7	136.7
Mechanism Control Electronics Box	31	15
Operational Heater Power (shown on next page)	**97**	**68**
Instrument Total	**648W**	**514.8W**

Operational Heater Power (Baseline)

Assembly	Average Heater Power (W)	Peak Heater Power (W)
Silicon PIN & Preamp Thermal Box	41	59
InGaAs PIN & Preamp Thermal Box	2	3
Fiber Optics Enclosure	15	21
Optics	10	14
Total	**68**	**97**

Operating mode heater power is sized in worst cold operating case

Survival Heater Power (Baseline)

Assembly	Average Heater Power (W)	Peak Heater Power (W)
MEB	54	77
MCEB	15	21
Digitizer Electronics	52	74
Silicon PIN & Preamp	59	84
InGaAs PIN & Preamp	5	7
Fiber Optics Enclosure	14	20
Optics	10	14
Mechanisms	35	50
Total	**244**	**349**

Radiators are sized for the worst hot operating case

Data Rate (Baseline)

<u>Instrument Detector Readout Data Rate</u>: instrument does not discard any data

- Assume 144 channels per scan
- 30 μs Integration Period
- Digitizing 16-bits, transmitting 14-bits each channel

⇒ **Raw digitized detector data: 67.2Mbps**

⇒ **2:1 compression implement in digitizer electronics (USES chip): 33.6Mbps**

<u>Additional Instrument Data that is included in the Instrument Data, but is negligible:</u>

- Housekeeping data (thermal, voltage, current, etc)
- Integration period measurements (taken for 12 detectors in both the baseline and delta instrument configurations)
- Dark current calibration images (possibly once per revolution)

<u>Instrument Packetization</u>: instrument data rate to the S/C

⇒ **There is 2% additional CCSDS overhead for packet headers: 34.272Mbps**

⇒ **Daily instrument data rate to S/C: 2961Gbits/day**

<u>Effective Instrument Downlink Data Rate from S/C</u>: the S/C may discard unuseful data for these considerations

⇒ **Discarding information beyond 102degrees**

⇒ **Discarding data beyond 70 degrees latitude**

⇒ **Discarding data taken over unlit Earth**

Harness Estimate (Baseline)

OCE2 Harness	Type	Backup	Primary	Flt Qty	Mass (ea)	Total Mass
Detector to Digitizer Box 1 (0.5m)	RS-422/analog	0	1	1	2.1	2.1
Detector to Digitizer Box 2 (0.5m)	RS-422/analog	0	1	1	2.1	2.1
Detector to Digitizer Box 3 (0.5m)	RS-422/analog	0	1	1	2.1	2.1
Detector to Digitizer Box 4 (0.5m)	RS-422/analog	0	0	0	0.0	0.0
Digitizer Box 1 to MEB (0.46m)	SpW	0	1	1	0.2	0.2
Digitizer Box 2 to MEB (0.59m)	SpW	0	1	1	0.2	0.2
Digitizer Box 3 to MEB (0.72m)	SpW	0	1	1	0.3	0.3
Digitizer Box 4 to MEB (0.85m)	SpW	0	0	0	0.0	0.0
Scan Motor & Inductosyn® Absolute rotary resolver to Mechanism Control Box (1.6m)	Power, Cmd, and Telm	1	1	2	1.3	2.7
Half Angle Motor & Inductosyn® Absolute rotary resolver to Mechanism Control Box (1.4m)	Power, Cmd, and Telm	1	1	2	1.2	2.4
Momentum Compensation Mechanism & Resolver to Mechanism Control Box (1.6m)	Power, Cmd, and Telm	1	1	2	1.3	2.7
Calibration Mechanism & Resolver to Mechanism Control Box (2m)	Power, Cmd, and Telm	0	1	1	1.7	1.7
Tilt Stepper Motor & Resolver to MEB (.5m)	Power, Cmd, and Telm	0	2	2	0.4	0.8
Scan Launch Lock to S/C Bulk Head (.7m)	Power	0	1	1	0.1	0.1
Tilt Launch Lock to S/C Bulk Head (.3m)	Power	0	1	1	0.1	0.1
Ops Heaters to MEB (1m)	Power	1	1	2	1.3	2.5
Op Temp Sensors to MEB (1m)	Analog	1	1	2	0.8	1.7
MEB to Mechanism Control Box (0.2m)	Power, Cmd, and Telm	0	1	1	0.2	0.2
MEB to S/C Bulk Head (1m)	1553	0	1	1	0.1	0.1
MEB to S/C Bulk Head (1m)	SpW + 1pps	0	1	1	0.5	0.5
MEB to S/C Bulk Head (1m)	Power	0	1	1	0.2	0.2
Survival Heaters & Mechanical Thermostats to S/C (.7m)	Power	1	1	2	3.4	6.8
					Total (Kg)	**29.28**